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Forest Insect and Disease Conditions in the Southwest 1978

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Cover photo: Douglas-fir tussock moth with pupal cocoon and egg mass. The female tussock moth is wingless and mates soon after emerging from the cocoon. After mating, she immediately lays a mass of eggs on the cocoon. The eggs are mixed with hairs from her body, giving the mass a furry appearance.

Forest Insect and Disease Conditions in the Southwest 1978

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Foreword

The major forest insect and disease infestations that occurred in the Southwestern Region in 1978 are discussed in this report. It was compiled by the Forest Insect and Disease Management staff in the Regional Office, and is intended to give a brief description of incidence, distribution, and trends of insect and disease activity on Federal, State, and private lands.

The Forest Insect and Disease Management (FIDM) group consists of a Staff Director, five forest entomologists (one of whom is a pesticide specialist), two forest pathologists, and a supportive staff of specialized biological technicians. These professionals provide technical assistance to all Federal and Indian Reservation forest managers in Region 3. Major responsibilities include detection, evaluation, and technical assistance.

Pest management must be considered as an integral part of forest management because pest-caused damages can significantly affect management objectives. The role of the pest management specialist is to advise the forest manager, and close coordination between the two is needed in making decisions in prevention, suppression, and long-term management plans.

Integrated pest management (IPM) is a concept that is receiving increased attention, although in forest pest management, it has been used to varying degrees for a number of years. Broadly defined, IPM is the consideration and use of one, or a combination of management tools to reduce the impact of a forest pest. It can be accomplished through silvicultural, chemical, or biological means. Many damaging forest insect and disease infestations can be prevented or reduced through proper forest management. Whenever possible, recommendations for prevention, usually through silvicultural means, are given to managers. To be effective, preventive techniques must be incorporated into the initial stages of the planning process. However, prevention is not always possible, even

in healthy stands. When outbreaks do occur, suppression alternatives are evaluated by FIDM personnel in terms of effectiveness, environmental safety, and economic efficiency. Often a recommendation of no control is a viable alternative.

Forest managers consider pest management recommendations, in addition to inputs from other specialists, to select the most suitable alternative. The FIDM group then provides technical assistance to help carry out the selected alternatives.

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Insect and Disease Conditions

Conditions in Brief

Bark beetle populations remained at low levels, with losses about the same as those reported in 1977. Widely scattered ponderosa pine, singly and in small groups, were killed by mountain pine beetle and western pine beetle throughout the Region. Roundheaded pine beetle caused some ponderosa pine mortality in southern New Mexico. Localized engraver beetle outbreaks occurred in central and southern Arizona. The most noted outbreak occurred on the San Carlos Indian Reservation where logging slash accumulated for several years, allowing populations to build up and attack live trees in that area. An engraver beetle caused heavy mortality in Mexican pinyon in Big Bend National Park in Texas. Small isolated groups of spruce were killed by spruce beetle in some areas.

Activity by major defoliators continued to increase. The number of acres defoliated by Douglas-fir tussock moth in New Mexico increased threefold over the acreages reported in 1977. There are eight separate identifiable infestations. Tussock moth defoliation caused top-kill and tree mortality to Douglas-fir and white fir. Moderate to heavy defoliation caused by western spruce budworm, primarily on Douglas-fir and white fir, increased from 25,000 to over 50,000 acres. Populations reached high levels on the Kaibab Plateau and Grand Canyon National Park in Arizona and on the Cibola and Carson National Forests in New Mexico.

Other defoliators included a scarab beetle on ponderosa pine, the New Mexico fir looper on Douglas-fir and white fir, and the western tent caterpillar on aspen.

Dwarf mistletoe continued to cause damage throughout the Region. Southwestern dwarf mistletoe was very prevalent on the Lincoln National Forest, N. Mex., and on the Apache-Sitgreaves and Prescott National Forests, Ariz. Use of a revised simulated yield program, RMYLD, that would provide land managers with an estimate of timber volume loss from dwarf mistletoe under various

management regimes, was initiated on National Forests in the Region. Ten thousand acres of mistletoe-infected ponderosa pine were surveyed for data input into the program.

Shoestring root rot was found on a large group of dead and declining Gambel oak on the Santa Fe National Forest, N. Mex., and was causing mortality in ponderosa pine plantations on the Apache-Sitgreaves National Forest, Ariz. Charcoal root rot was identified on dead ponderosa pine seedlings in plantations on the Kaibab National Forest, Ariz.

Fir broom rust was found in varying degrees of intensity on all forests. Groups of severely infected trees were reported in the Sandia Mountains, Cibola National Forest, N. Mex. Spruce broom rust and limb rust remained relatively minor problems.

Chloride toxicity from road deicing salt resulted in considerable mortality of trees in several areas in New Mexico. Evaluation of declining trees in two areas showed that all trees showing damage were dead within 3 years.

Status of Insects

Mountain pine beetle, *Dendroctonus ponderosae* Hopk. Widely scattered ponderosa pines, killed by the mountain pine beetle, were detected in northern Arizona and New Mexico. Single "faders" and groups of 2 to 10 dead trees were most commonly observed. Very few groups exceeding 20 trees were found.

In Arizona, the infestation on the Kaibab National Forest declined to a low level. Activity continued on the adjoining Grand Canyon National Park, but losses were minimal. This beetle attacks and kills relatively thrifty trees growing on the best sites. Approximately one half million bd. ft. of timber was killed by mountain pine beetle in Arizona in 1978. No suppression or salvage programs were undertaken.

Overmature, decadent pines growing on poor sites appear to be preferred by the mountain pine beetle in northern New Mexico. As in 1977, widely scattered tree mortality occurred on the Canjilon, El Rito, Jicarilla, Penasco, Taos, and Tres Piedras Ranger Districts, Carson National Forest; and on the Coyote, Cuba, Espanola, Jemez, Las Vegas, and Pecos Ranger Districts, Santa Fe National Forest. Approximately three quarter million bd. ft. of timber was killed in New Mexico. Although dead trees were too scattered to justify salvage, many were utilized by free-use, fuelwood cutters. Dead and

down trees on these National Forests are an important source of fuelwood for local residents.

Western pine beetle, *Dendroctonus brevicomis* LeC. Widely scattered trees, singly or in small groups, were killed by this beetle over much of the ponderosa pine type in the Region. Tree losses were about the same as has been detected in recent years on the Apache-Sitgreaves, Coconino, Coronado, Kaibab, Prescott, and Tonto National Forests, Ariz., and Gila and Lincoln National Forests, N. Mex.

Large diameter trees hit by lightning, or weakened by diseases or other factors are preferred by this beetle. Salvage is impractical; however, it has been determined that these trees left in the forest make a desirable wildlife habitat.

Roundheaded pine beetle, *Dendroctonus adjunctus* Blandf. Ponderosa pine mortality from this insect continued on the Lincoln National Forest and Mescalero Apache Indian Reservation, N. Mex. Scattered tree mortality occurred around Cloudcroft, Lincoln National Forest, and on the Mescalero Apache Indian Reservation. The heaviest tree losses were in Five Canyon and Seven Canyon, Mescalero Apache Indian Reservation. Pole-sized trees are most commonly attacked by this insect. Since there are few markets in this area for pole-sized material, opportunities for salvaging infested trees have been limited.

Engraver beetles, *Ips* spp. Ponderosa pine losses due to these bark beetles were considerably less than has been detected in recent years. Adequate and well-spaced rainfall, which increased tree vigor, helped to reduce tree losses. Thinning and logging slash was created over thousands of acres of pine type in central and southern Arizona, where engraver beetle outbreaks normally occur; however, beetles nurtured in the slash failed to cause substantial tree mortality in nearby standing areas. Localized and minor outbreaks occurred on the Pinedale Ranger District, Apache-Sitgreaves National Forest; Flagstaff and Elden Ranger Districts, Coconino National Forest; Chino Valley and Crown King Ranger Districts, Prescott National Forest; and Navajo Indian Reservation, Ariz.

An intense infestation occurred on the San Carlos Indian Reservation in southern Arizona where ponderosa pine logging slash was created over a 2½-year period. Arizona five-spined ips, *Ips lecontei* Sw., attacked the slash, completed several generations each year, and

reached a high population level in 1978. When no additional slash or weakened pines were available beetles moved en masse to nearby live trees. Over 60 spots of dead pole- and sawtimber-size trees, some exceeding 400 trees in size, were detected during the 1978 aerial survey. In addition, many green infested trees were found during subsequent ground examinations. Top-killed trees were also common. The Tribe planned to harvest accessible, sawtimber-size trees. The infestation was detected too late for suppression to be a viable alternative.

In Big Bend National Park, Tex., droughty conditions permitted an engraver beetle species, probably *Ips hoppingi* Lan., to increase and cause heavy mortality of Mexican pinyon. Tree losses as high as 40 to 50 percent may have occurred in portions of Green Gulch. The loss of these trees, which are typically sparse, adversely affected aesthetic values.

Regional entomologists intensified efforts to encourage resource managers to institute preventive measures in resource planning and action programs.

Spruce beetle, *Dendroctonus rufipennis* (Kby.) Small isolated groups of spruce beetle-killed trees were detected throughout the Region during aerial surveys. Tree mortality was found on the Lincoln and Santa Fe National Forests, N. Mex., and the Coconino National Forest and Fort Apache Indian Reservation, Ariz.

Western spruce budworm, *Choristoneura occidentalis* Free. Visible defoliation caused by this insect decreased from 197,788 acres in 1977 to 78,535 acres in 1978. Because of increased tree growth in 1978, compared to 1977, much of the defoliation normally classed as light on aerial detection surveys was not seen. There was a twofold increase in visible defoliation in the moderate to heavy classes from 1977 (25,796 acres) to 1978 (51,494 acres). Budworm populations have reached high levels on the Kaibab Plateau, Kaibab National Forest, and Grand Canyon National Park, Arizona; the Mountainair Ranger District, Cibola National Forest, the Questa and Taos Ranger Districts, Carson National Forest, and the Taos Pueblo Indian Reservation, N. Mex. Egg mass surveys indicate an increasing infestation trend with moderate to heavy defoliation in 1979 on these areas.

Sampling continued on the western spruce budworm suppression-evaluation project, Jemez Mountains, N. Mex. Larval populations remained below 1.0 larvae per 100 buds (.9) in an area treated in

1977 (Figure 1). Larval populations dropped 18 percent in the untreated area to 8.7 larvae per 100 buds.

Percent defoliation for white fir and Douglas-fir in the treated and untreated units is listed below:

	Percent Defoliation			
	Douglas-fir		*White fir*	
	1977	*1978*	*1977*	*1978*
Treated Unit	*26.5*	*2.9*	*37.1*	*5.3*
Untreated Unit	*40.7*	*27.9*	*61.2*	*47.4*

Figure 1: Spruce budworm larva mining in a fir bud. The small hole in the bud and the silken webs around the bud are indications of budworm activity.

Over the 2-year period from 1977 to 1978, foliage saved by the suppression project was 39.3 percent for Douglas-fir and 66.4 percent for white fir.

Assessment of population changes and resultant tree damages will continue in each unit for 3 to 5 years.

Douglas-fir tussock moth, *Orgyia pseudotsugata* (McD.). In New Mexico, the tussock moth defoliated 7,000 acres of forested land—a threefold increase from 1977. There were eight separate infestations ranging in size from 300 to 2,500 acres, and from 1 to 4 years in age. All infestations occured in mixed conifer type in steep-sided drainages. In each outbreak, the tussock moth defoliation resulted in top-kill and tree mortality to Douglas-fir and white fir. A new outbreak of 1,000 acres of heavy defoliation was found in Bear Canyon on the west side of the Sandia Mountains on private land adjacent to the Cibola National Forest, N. Mex. Survey results indicated a continued increase in the intensity and severity of the outbreaks for 1979. Several canyon infestations have the potential to spread into large host-type acreages. All infestations could sustain heavy tree mortality over the next 3 to 4 years. The tussock moth is a cyclic insect. In New Mexico, infestations are known to persist up to 10 years.

A cooperative pilot project between Federal, State and county agencies was conducted in Los Alamos, N. Mex., using nucleopolyhedrosis virus and carbaryl. Results of the Project are discussed in further detail under the State of New Mexico Insect and Disease Conditions.

In Arizona, Douglas-fir tussock moth infestations remained at a low level. Surveys conducted near Aztec Peak, Pleasant Valley Ranger District, and Pinal Peak, Globe Ranger District, Tonto National Forest, showed less than one larva per 1,000 square inches of foliage. Infestation levels were expected to remain low in 1979.

Western tent caterpillar, *Malacosoma californicum* (Pack.). Medium to heavy defoliation in aspen stands occurred on the Santa Fe National Forest and Bandelier National Monument, N. Mex. This was the third year of moderate to heavy defoliation on the Espanola, Coyote, Tesuque, and Jemez Ranger Districts. Branch mortality was noted in some areas. Small centers of light defoliation were observed on the Cibola and Carson National Forests, N. Mex. Infestations on the Kaibab National Forest, Ariz., collapsed.

Western tent caterpillar outbreaks usually last for 3 to 4 years.

Tree damage rarely reaches a point where control can be justified; however, the presence of the caterpillars and the defoliation in the spring cause concern to the public in high-use and recreation areas.

New Mexico fir looper, *Galenara consimilis* Hein. Approximately 500 acres of heavily defoliated stands of Douglas-fir and white fir were detected in Bonito Creek, Smokey Bear Ranger District, Lincoln National Forest, N. Mex., in 1977. In 1978, populations collapsed in this area. Approximately 90 percent of the trees defoliated in 1977 died in 1978.

A scarab beetle, possibly *Phyllophaga* sp. Feeding adults caused moderate to heavy defoliation of ponderosa pine stands around the T-Bar Grasslands, Gila National Forest, N. Mex., for the third consecutive year. In 1976 and 1977, only a few trees near the Negrito Fire Base were affected; however, in 1978, over 7,000 acres of defoliation were detected.

Little is known about the biology of this species. Evaluations have only been done when adults were present. Large numbers of adults were found in the duff under defoliated trees, but no other life stages could be found. Adults apparently hide in the duff during the day and come out to feed at night.

The defoliation was not expected to cause any top-killing or mortality of the pines; however, damages could be expected to occur if heavy defoliation continued in 1979. Some weakened trees could be predisposed to bark beetle attack.

A leaf beetle, *Trirhabda nitidicollis* LeC. This beetle defoliated several hundred acres of rabbitbrush, *Chrysothamnus nauseosus*, in Bonito Canyon, Mt. Taylor Ranger District, Cibola National Forest. Defoliation was spotty, with some areas being almost completely defoliated and others only partially defoliated. The aerial portions of many plants appeared to have been killed by insect feeding, especially in an area north of Malpois Spring. The long-term effects in rabbitbrush, which is considered an undesirable plant, is yet to be determined. It is possible that this leaf beetle is depleting stands of rabbitbrush, thus improving range conditions.

Other Insects.

Name		Host	Locality	Remarks
Common	**Scientific**			
Alder flea beetle	*Altica ambiens* LeC.	Arizona alder	Prescott NF, Ariz.	
Coneworm	*Dioryctria* sp.	ponderosa pine	Coconino NF, Ariz. Lincoln NF, N. Mex.	
Fir engraver	*Scolytus ventralis* LeC.	Douglas-fir true fir	Ariz. & N. Mex.	scattered throughout
Pine seed chalcid (a)	*Megastigmus albifrons* Walk.	ponderosa pine	Kaibab NF, Ariz.	
Pinyon ips	*Ips confusus* (LeC.)	pinyon	Ariz. & N. Mex.	scattered throughout
Pinyon needle scale	*Matsucoccus acalyptus* Herb.	pinyon single leaf pinyon	Ariz. & N. Mex.	scattered
Pinyon pitch nodule moth	*Petrova albicapitana arizonensis* (Hein.)	pinyon	Ariz. & N. Mex.	twig damage on ornamentals
Pinyon sawfly	*Neodiprion edulicolus* Ross.	pinyon	Cibola NF, N. Mex.	
Ponderosa pine cone beetle	*Conophthorus ponderosae* Hopk.	ponderosa pine	Kaibab NF, Ariz. Jicarilla Apache Indian Reservation, N. Mex.	
Ponderosa pine seed moth	*Laspeyresia piperana* (Kear.)	ponderosa pine	Kaibab NF, Ariz. Bandelier National Monument & Lincoln NF, N. Mex.	

Prescott scale	*Matsucoccus vexillorum* Morr.	ponderosa pine	Williams, Ariz. Los Alamos, N. Mex.	
Southwestern pine tip moth	*Rhyacionia neomexicana* (Dyar.)	ponderosa pine	Apache-Sitgreaves, Coconino, and Kaibab NF, Ariz.	
Tiger moth (a)	*Halisidota ingens* Hy. Edw.	ponderosa pine	Ariz. & N. Mex.	scattered throughout

Status of Diseases

Dwarf mistletoe, *Arceuthobium* spp. Losses from southwestern dwarf mistletoe, *Arceuthobium vaginatum* subsp. *cryptopodum* (Engelm.) Hawks. and Wiens, on ponderosa pine, were most prevalent on the Apache-Sitgreaves, Lincoln, and Prescott National Forests. Mortality was scattered throughout all forests. On the Apache-Sitgreaves National Forest, spittlebugs (*Clastroptera distincta* Doer.) were again noted feeding on dwarf mistletoe causing some mortality of aerial shoots. Douglas-fir dwarf mistletoe, *A. douglasii* Engelm., was common in mixed conifer stands in the southern half of New Mexico and Arizona, and on the Carson National Forest, N. Mex. A survey to refine incidence and loss estimates on Douglas-fir is planned. Other species causing timber losses were *A. apachecum* Hawks. and Wiens on southwestern white pine and *A. microcarpum* (Engelm.) Hawks. and Wiens on Engelmann spruce.

Use of the revised simulated yield program for ponderosa pine, RMYLD, was initiated on National Forests in the Southwest. This program provides resource managers with an estimate of timber volume loss due to dwarf mistletoe under various management alternatives. Approximately 10,000 acres of mistletoe-infected ponderosa pine were surveyed for input into the RMYLD program. These surveys were conducted on the Apache-Sitgreaves, Lincoln, Prescott, Santa Fe, and Tonto National Forests, and state land in Arizona. Information gathered in these surveys was used by land managers to incorporate mistletoe control into timber management practices. These results were also used to train district personnel in the use of the program.

Data gathered from surveys conducted over the last 4 years in mistletoe-infected ponderosa pine stands are being processed by the RMYLD program to provide a new, more accurate estimate of timber volume loss for the Region.

The mistletoe control project on the Horsethief Basin Recreation Area, Prescott National Forest, Ariz., was partially completed in 1978. Removal of all trees with a dwarf mistletoe rating of three or above from a travel influence zone and three campgrounds will continue in 1979. In addition, lightly infested trees in the campgrounds will be pruned to reduce mistletoe buildup.

Shoestring root rot, *Armillariella mellea* (Vahl. ex Fr.) Karst. A large group of dead and declining Gambel oak on the Santa Fe National Forest, N. Mex., was infected with shoestring root rot.

This root rot, which acts as a natural thinning agent in dense reproduction, was also found causing mortality in ponderosa pine plantations on the Apache-Sitgreaves National Forest, Ariz., and at endemic levels throughout the Region.

Charcoal root rot, *Macrophomina phaseoli* (Maubl.) Ashby. This disease was identified on dead ponderosa pine seedlings in plantations on the Kaibab National Forest, Ariz. Primarily a nursery disease, charcoal root rot can cause mortality when infected seedlings are stressed in outplanting situations. Proper nursery fumigation procedures, shown to provide good control in similar situations, would have prevented the occurrence of the disease in the plantations.

Fir broom rust, *Melampsorella caryophyllacearum* Schroet. Fir broom rust was found in varying degrees of intensity on all forests. Preliminary results of a distribution and intensity survey of fir broom rust on the Carson National Forest, N. Mex., part of a Regionwide survey, showed that this disease is of relatively minor importance on that Forest. However, groups of severely infected trees, some with bole infections (Figure 2), were reported in the Sandia Mountains, Cibola National Forest, N. Mex.

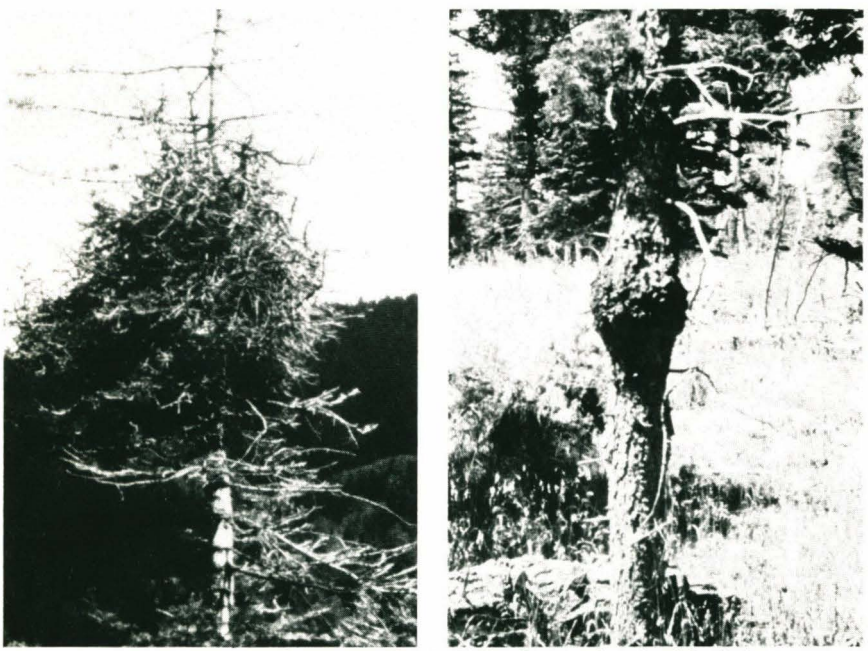

Figure 2: (Left) Witch's broom and top dieback associated with fir broom rust. (Right) Bole infection on white fir caused by the rust.

Spruce broom rust, *Chrysomyxa arctostaphyli* Diet. This disease continued to cause some top dieback and limited tree mortality on Engelmann Spruce throughout the Region. Pockets of large, infected trees were found on the Carson National Forest, N. Mex.

Limb rust, *Peridermium filamentosum* Pk. Limb rust remained a minor problem in ponderosa pine on all forests. Branch mortality and limited tree mortality occurred on the Coconino, Kaibab, and Santa Fe National Forests. This disease causes important losses when it occurs in seed trees.

Trunk rots. *Echinodontium tinctorium* (E. & E.) E. & E. was found on white fir and Douglas-fir in overmature stands on the Apache-Sitgreaves and Kaibab National Forests, Ariz., and on the Carson and Cibola National Forests, N. Mex. Infected white fir trees were also found in campgrounds on the Cibola National Forest.

The status of other trunks rots in the Region remained the same—present, but not important.

Nursery diseases and mycorrhizae. Containerized seedlings from the Bureau of Indian Affairs Nursery at McNary, Ariz., exhibited a variety of symptoms related to irrigation problems and nutrient deficiencies. Mortality in ponderosa pine seedlings from the BIA greenhouse at Dulce, N. Mex., was related to various species of damping-off fungi.

Due to the high pH of both soil and water, 1-0 ponderosa pine seedlings at the Albuquerque Tree Nursery were stunted and had discolored foliage (Figure 3). Lack of nutrient availability, resulting from the high pH, was being treated by injecting acid into the irrigation system in an attempt to lower soil pH. The results are inconclusive.

Mid-season evaluation samples of seedlings from test beds seeded with inoculum provided by the Mycorrhizal Institute in Athens, Ga., were collected at the Nursery. The seedlings were sent to Athens where root examinations will determine the presence and levels of mycorrhizal infection by the fungus *Pisolithus tinctonius* (Pers.) Cooper and Couch.

Containerized ponderosa pine seedlings from a U.S. Forest Service greenhouse in Albuquerque, N. Mex., showed tipburn and mottling of needles characteristic of air pollution damage.

Due to improper handling and storage, seedlings on the Lincoln National Forest, N. Mex., were damaged by several species of mold. Damage consisted of reduced vigor and some seedling mortality.

Salt damage. Heavy applications of road deicing salt caused considerable mortality to trees in several areas of New Mexico. Affected species included ponderosa pine, white fir, corkbark fir, Engelmann spruce, Douglas-fir, and aspen.

Evaluations of declining trees on the Cibola and Santa Fe National Forests showed that all trees showing symptoms of damage were

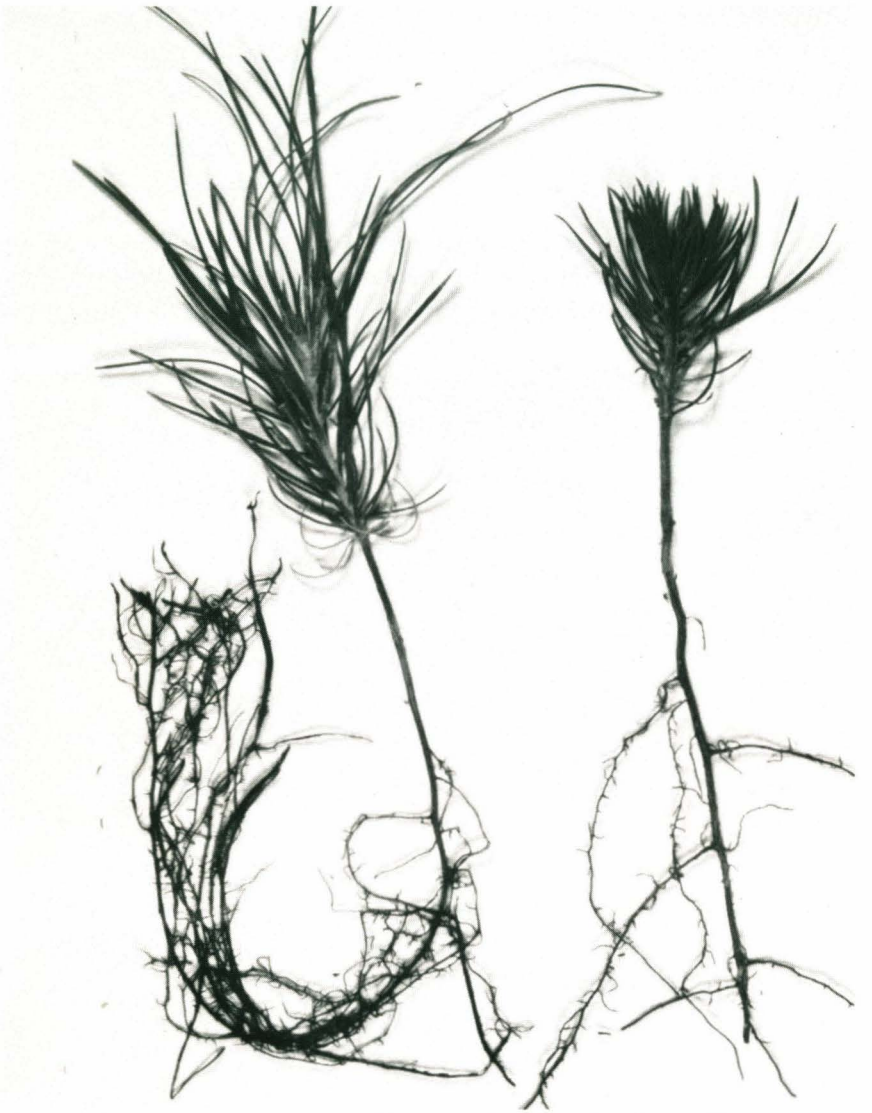

Figure 3: Ponderosa pine seedlings: (Left) 7-week-old seedling from a containerized, greenhouse operation; (Right) 7-month-old, stunted, discolored, seedling from Albuquerque Tree Nursery.

dead within 3 years. All trees were located on the downslope side of the road within 25 feet of the roadside.

Weather. Snow-bending of ponderosa pine saplings, caused by late snowfalls, was reported from various forests in the Region. While not a serious mortality problem, this bending could result in future volume loss due to deformed trees.

Numerous lightning-struck trees, often those left as seed trees, were observed in central and northern Arizona. Damaged trees on the Apache-Sitgreaves, Coconino, and Kaibab National Forests were characterized by dead and dying tops. These trees were often the target of secondary insect infestations.

Drought was not a serious factor in the Southwest in 1978.

Animal damage. Rodent damage to ponderosa pine was again found on several plantations on the Santa Fe National Forest. Trees were both girdled and cut off at the base. Porcupine damage to ponderosa pine was seen in several areas on the Carson National Forest. Elk "barking" of aspen was also common on both the Carson and Santa Fe National Forests.

Other Diseases.

Name		Host	Locality	Remarks
Common	**Scientific**			
Foliage diseases	*Elytroderma deformans* (Weir) Dark.	ponderosa pine	Navajo Army Depot, Arizona	also scattered throughout Region
	Linula abietis-concoloris (Mayr. ex Dearn.) Dark.	white fir	Ariz. & N. Mex.	scattered
	Rhabdocline pseudotsuga Syd.	Douglas-fir	Ariz. & N. Mex.	scattered
Juniper rust (a)	*Gymnosporangium* spp.	juniper	Cibola NF, N. Mex.	scattered
Needle cast	*Lophodermella cerina* (Dark.) Dark.	ponderosa pine	Gila NF, N. Mex.	

Forest Insect and Disease Detection and Evaluation

The Forest Insect and Disease Management group of the U.S.D.A. Forest Service is responsible for detection, evaluation, management, and technical assistance to land managers on all Federal lands in Arizona, New Mexico, and western Texas. In addition, they cooperate and provide assistance to State forest entomologists and pathologists.

Detection Surveys

One of the main responsibilities of FIDM is to detect and monitor insect and disease outbreaks and infestations. This is accomplished through both aerial and ground survey techniques. Aerial surveys are used to detect new outbreaks, monitor ongoing infestations, and determine the extent and location of the damage. These surveys are conducted from low flying aircraft in an organized and systematic manner in order to detect all visible damage.

In total, 14.4 million acres were surveyed by FIDM personnel from July through September, 1978.

State	Ownership	Acres (millions)
Arizona	*National Forest*	*5.10*
	National Park Service	*0.10*
	Indian Lands	*1.80*
	Other Federal, State, and Private*	*0.10*
New Mexico	*National Forest*	*5.60*
	Indian Lands	*0.60*
	Other Federal, State, and Private*	*1.00*
Texas	*National Park Service*	*0.01*
TOTAL		*14.31*

**Other Federal ownership includes Bureau of Land Management, National Monuments, Department of Energy, and U.S. Military installations.*

After the surveys are made, a map, showing the location, extent, and kind of outbreaks occurring is forwarded to the resource managers of the respective administrative units.

Field Surveillance

Land managers and forest workers should be alert for any unusual insect or disease activity as they conduct their normal field activities. Aerial surveys can only detect damage after it has occurred, while forest workers on the ground often discover the beginning of a potential problem. Prompt reporting of new or unusual insect or disease activity is necessary for early detection of potential pest problems. Detection forms and surveillance kits are provided to land managers by the Forest Service and the State Agricultural departments. State and private landowners should report on the form provided by the States. Federal and Indian Reservation land managers should report information on the revised Forest Insect and Disease Surveillance Work Sheet forms furnished by FIDM. This new work sheet will replace the old 5200-5, Detection Report, Forest Insect and Disease Damage, that has been used previously. Check appropriate boxes and make sure all pertinent information is provided. Probably the most important section on the new work sheet is the addition of a remarks section, in which the land managers can give a more detailed description of the problem. Often it is the comments in a remarks section that are most useful in helping entomologists and pathologists identify a problem.

The revised Field Surveillance Work Sheet and surveillance kits for shipping specimens, will be distributed to Federal land managers within Region 3.

Evaluation and Assistance

Much of the major responsibility of FIDM includes not only informing land managers of existing problems, but also providing assistance through evaluations and recommendations on how to manage pest problem through a program of integrated pest management. Twenty-two evaluations were conducted on major forest pests in 1978.

Entomology: During 1978, entomologists were involved in several major projects including: 1) the second-year monitoring on a western spruce budworm suppression and evaluation project on

the Santa Fe National Forest to determine long-term effects of treatment with carbaryl versus no immediate treatment; 2) initiating a loss assessment survey to determine tree damage and losses from western spruce budworm in relation to the population dynamics of the insect; 3) working with the Methods Application Group in Davis, California, to develop an improved western spruce budworm egg mass sampling system; 4) conducting workshops for land managers on silvicultural practices to prevent *Ips* beetle outbreaks; and 5) participating in Silvicultural Certification Workshops by providing training in insect and disease recognition and management. Only one project involving aerial application of an insecticide was conducted. This was a pilot project involving the large-scale application of nucleopolyhedrosis virus for Douglas-fir tussock moth near Los Alamos, New Mexico.

Pathology. RMYLD is a simulated yield program for ponderosa pine. The effects of dwarf mistletoe on ponderosa pine are built into the program so that losses from mistletoe can be projected. In 1978, pathologists conducted 12 surveys (two on Arizona State lands) to gather data for input into RMYLD. Workshops were conducted on Ranger Districts on the use of RMYLD. Pathologists also cooperated with the Methods Application Group on a mistletoe loss assessment study to develop a new and more precise estimate of Regionwide volume loss in ponderosa pine.

Other major pathology projects included: 1) initiating a fir broom rust survey that will give the intensity and distribution of fir broom rust in Region 3, and determine whether losses are of economic significance; 2) conducting an evaluation to determine the impact of road deicing salt on trees along selected roadsides; and 3) cooperating with the Rocky Mountain Station and Region 2 on a study to determine the relationship between logging practices and disease incidence in aspen stands.

Assistance was given to the Albuquerque Tree Nursery and the BIA greenhouse on how to avoid environmental conditions that could cause disease problems. In addition, pathologists cooperated with the Mycorrhizal Institute in Athens, Georgia, on a national mycorrhizae nursery evaluation including 32 Federal, State, and private nurseries in 28 states.

State of Arizona Insect and Disease Conditions State and Private Lands

by Robert Celaya

The major bark beetles occurring in Arizona in 1978 were *Ips* engraver beetles, which caused damage to ponderosa pine, mainly near Prescott, Payson, and Flagstaff. Overall, losses were not as high as those reported the previous year.

There were several species of insects that affected the needles and foliage. A pine needle miner was found on about 3,000 acres of ponderosa pine near Show Low-Lakeside, Flagstaff, and on the Navajo Indian Reservation. About 600 acres of ponderosa pine west of Springerville were defoliated by a conifer sawfly. Damage was not serious since it occurred on a marginal ponderosa pine site.

Nuisance insects were widespread on State and private forested lands. Conifer aphids, spiny elm caterpillars, and tiger moths were visible in early spring. Spider mites were present throughout the juniper vegetation type. None of these pests caused serious damage. A number of miscellaneous pest problems, such as tent caterpillars, webworms, pineshoot borers, and leafrollers, also occurred.

Dwarf mistletoe control was expanded in 1978. Emphasis was placed on State and private lands near Flagstaff, and on private lands in and around Prescott, Strawberry, and Pinetop.

Problems related to urbanization caused tree mortality on private lands. Housing construction in forested areas created large amounts of green pine slash that provided breeding sites for *Ips* beetles. Serious mechanical damage to standing trees also occurred.

Conifer aphids, *Cinara* spp. Aphids were extremely abundant throughout the ponderosa pine type. Large amounts of "honeydew," a substance produced by adult aphids, were evident around Prescott and Payson. On needles, this substance creates a medium on which black "sooty-mold fungus" grows. However, insect predators such as lady beetles and fly larvae were widespread, and effectively reduced the pest to innocuous levels.

Spiny elm caterpillar, *Nymphalis antiops* L. These caterpillars were identified on lombardy poplar in Payson, and on aspen in Flagstaff. Neither tree species was seriously defoliated. Chemical and cultural control methods were recommended.

Tiger moth, *Halisidota ingens* Hy. Edw. Defoliation from this insect was noticeable in April on ponderosa pine. Tents were very visible on the treetops from Flagstaff to Pinetop. Needle defoliation by the tiger moth larvae was limited to the area around the tent. Parasitic wasps and flies killed a high percentage of tiger moth larvae.

Pinyon needle scale, *Matsucoccus acalyptus* Herb. Emergence occurred in early March near Prescott, Arizona. Normally, egg hatch does not occur until May. A large number of crawlers hatched out settled on the second year growth. Shortly after emergence, a natural agent apparently controlled most of the crawlers. No explanation for the apparent population collapse could be given. Little information on the natural control of pinyon needle scale is available. Follow-up examinations will be undertaken in early spring to determine the extent of any overwintering populations.

***Ips* beetle, *Ips* sps.** Damage to ponderosa pine occurred in March, primarily around Prescott. *Ips* beetle damage was also detected in the Payson area. This was the first time *Ips* had been found on live ponderosa pine near this city. Infested trees were widely scattered. About 1 acre of infested ponderosa pine was detected in late fall, southwest of Flagstaff. The insect populations had apparently built up on green ponderosa pine slash on private land. This problem will continue to occur as long as green pine slash is present. Removal, piling, and burning of the infested material will be initiated this winter and next spring.

Pine needle miner, *Coleotechnites* sp. This insect was found Statewide. Damage to ponderosa pine in the Show Low-Lakeside area was previously thought to be caused by the first larval instar of tip moth. Needle discoloration was first noticed in 1976, and has been slowly increasing. The largest area of infestation covers about 2,000 acres. The yearly defoliation has not caused visible mortality, but the possibility of secondary insects attacking the weakened trees is of concern. Since the damage has occurred gradually, it has not caused much public concern; however, information on the problem is available to the local population.

Small, scattered pockets of infested ponderosa pine were also located west and south of Flagstaff. This needle miner appears to be a different insect from the one identified in the Show Low-Lakeside area.

A pine needle miner was also identified on the Navajo Indian Reservation west of Window Rock in the Cross Canyon area. About 2,000-3,000 acres of defoliated pinyon was located. Repeated defoliation has caused some mortality in older trees.

Little information is available on needle miners on ponderosa and pinyon pine, and control measures for these insects are not practical nor economical at present. Occurrence of these pests seems to be sporadic, and the outbreaks short-lived. The needle miner infested areas will be monitored to see if any infestation trends can be detected. Several parasitic wasps have been collected from needle miner infested trees.

Conifer sawfly, *Neodiprion* sp. This sawfly occurred for a second year west of Springerville on Highway 260. The sawflies were defoliating ponderosa pines scattered throughout a grassy area. Larvae have been feeding on the previous year's, or older, foliage. Although the damaged trees present a sparse, tufted appearance, no serious losses were anticipated. The site was marginal for ponderosa pine, and the insects have not been detected in the adjacent stands of pine. Examination of the area in early spring will be made in order to determine the level of infestation.

Other insects. Numerous other pests were detected including roundheaded, western, and Mexican pine beetles, carpenter ants, pine needle scale, spruce gall aphids, cicadas, pine webworms, false webworms, tent caterpillars, spittlebugs, leafrollers, and pineshoot borers. Damage by these insects was minimal, and either cultural, chemical, or no control methods were recommended.

Spider mites, *Oligonychus* spp. Spider mites were abundant in late spring on juniper trees. Prescott, Payson, and Show Low-Lakeside-Pinetop experienced buildups of these pests. Webbing produced by the mites enveloped large junipers giving them a dirty, dingy appearance. Regular spraying with a strong stream of water was prescribed, and early summer wind and rain washed off most of the unsightly webbing. No serious damage occurred to the infested trees.

Dwarf mistletoes, *Arceuthobium* spp. Mistletoes continued to

be the most damaging agents in Arizona's forests. Dwarf mistletoe control was emphasized on State and private lands near Flagstaff, and on private lands in and around Prescott, Strawberry, and Pinetop. Data gathered in a mistletoe survey covering 640 acres of State land and 160 acres of private were incorporated in a RMYLD program. Yield tables were developed from infested stands to determine what silviculture measures might be implemented. Silvicultural treatments on State and private forested lands and individual pruning of infected trees will be expanded in 1979.

Urbanization problems. Urbanization problems continued to cause serious tree mortality Statewide. Increased house construction in forested areas created large amounts of green ponderosa pine slash, ideal for *Ips* beetle reproduction. University Heights, outside of Flagstaff, and the Pinetop Lakes subdivision, near Pinetop, were the two examples of this situation. Although the insects have not attacked the green standing trees, the chances of this occurring are high as populations build up in the slash. Information on slash disposal has been provided in these areas, but the problem continues.

Branch, trunk, and root damage, caused by heavy construction equipment, was also common.

State of New Mexico Insect and Disease Conditions State and Private Lands

by Tony Smith

Defoliating insects generally decreased on most State and private lands in northern New Mexico. Western spruce budworm populations caused light defoliation on fewer than 7,000 acres of private lands in northeastern New Mexico. Population decline was unexpected and tree damage and losses have been minimal. Western tent caterpillar defoliation on aspen stands continued for the fourth year, but refoliation was good. Douglas-fir tussock moth populations declined as a result of natural causes in two areas, and increased in another area to about 1,200 acres. A pilot control project to demonstrate the effectiveness of an aerial application of a nucleopolyhedrosis virus on a 1,200-acre infestation of Douglas-fir tussock moth was completed successfully in Los Alamos. Larval mortality exceeded 95 percent. Two chronic infestations of pinyon needle miners continued to defoliate about 2,400 acres of pinyons west of Taos, and another 800 acres south of Zuni; however, populations have declined substantially.

Mountain pine beetles continued to kill scattered single ponderosa pines throughout northern New Mexico, especially overmature trees. Western pine beetles caused about the same mortality to small groups of ponderosa as reported in 1977. No major infestations occurred in 1978. Douglas-fir beetle attacks on groups of 25 to 100 trees occurred on lands east of the Carson National Forest. Infestations were on poor sites and in areas of low precipitation. No spruce beetle infestations were detected in 1978.

Other insects of note in New Mexico included pinyon needle scale (440 acres), *Ips* spp. engraver beetles, pine tip moth, fall webworm, elm leaf beetle, and European elm scale.

Western spruce budworm, *Choristoneura occidentalis* Free. Visible defoliation by this insect decreased from over 26,000 acres in 1977 to less than 7,000 acres in 1978. The major infestation was still

centered on the Philmont Scout Ranch, near Cimarron; however, defoliation was light and tree losses were minimal. Egg mass densities were down considerably from 1977, and similar defoliation is expected in 1979. Small private acreages within the Santa Fe National Forest, west of Los Alamos, were heavily infested, and control measures are being considered around some recreational cabin sites.

Douglas-fir tussock moth, *Orgyia pseudotsugata* (McD.). The chronic infestation of ornamental spruce, true firs, and Douglas-fir continued in Santa Fe. Although many of the trees have been sprayed annually for 6 or more years, the insect continues to be a problem. The resistance of many property owners and groups to chemical treatment precludes a concerted city-wide suppression project.

A pilot project was conducted near Los Alamos to demonstrate the effectiveness of an aerial application of nucleopolyhedrosis virus against tussock moth larvae. More than 1,900 ornamental trees were treated with a ground application of carbaryl. Infestations on 1,200 acres in Los Alamos and Pueblo Canyons were treated with helicopter-applied nucleopolyhedrosis virus. Suppression resulted in 95 and 99 percent larval mortality for the virus and carbaryl, respectively. No new egg masses were detected in the virus treated areas in the fall. However, infestations are expected to continue in the Los Alamos area, as several pockets of defoliation occurred outside the treatment area.

Pheromone-baited detection traps were placed on two private ownerships in northeastern New Mexico where moths were detected in 1977. Only 15 moths were trapped in 160 traps, compared to an average of 13 moths per trap the previous year. Population reduction is a result of natural causes and no serious problems were anticipated for 1979. The use of traps will be discontinued in 1979.

A new infestation of approximately 1,000 acres was detected on private land on the west side of the Sandia Mountains. A control project is being considered for 1979.

Pinyon needle miner, *Coleotechnites* n. sp. Populations of this insect have decreased substantially. Light defoliation occurred in only two areas. A 7-year infestation was still active on 2,400 acres west of Taos. Some scattered tree mortality was evident. Most live trees were characterized by few needles and many dead branches.

Another infestation, on 800 acres south of Zuni, has collapsed as a result of natural causes.

Pinyon needle scale, *Matsucoccus acalyptus* Herb. New infestations of this scale insect were detected east of Alamogordo and north of Taos. The Taos infestation was heavy on about 400 acres. Large-diameter pinyon trees retained only current foliage that was greatly reduced in length. Drought enhanced poor tree condition, and *Ips* sp. engraver beetles attacked some of the weaker trees. The 40-acre infestation near Alamogordo was treated with dimethoate in the early spring.

European elm scale, *Gossyparia spuria* (Mod.). Most of the American elms in Socorro, Santa Fe, Las Vegas, and Raton are heavily infested with this scale and some *Lecanium* sp. scales. Sooty mold fungus, growing on the honeydew secreted by the insect, has turned upper branches, limbs, and trunks black. These sucking insects have caused considerable limb and branch mortality, creating ideal breeding places for *Scolytus multistriatus*, the smaller European elm bark beetle.

Engraver beetles, *Ips.* spp. As New Mexico's population grows and the pressure for recreational cabins and "homes in the woods" increases, more landowners are requesting advice on engraver beetle problems. This is true especially in pinyon-juniper woodlands adjacent to the Lincoln, Cibola, and Santa Fe National Forests. The greatest problem is one of education. Most beetle attacks occur in trees damaged during home construction. Typically, 10 to 25 pinyon trees can be attacked by engraver beetles during or soon after construction on a home is completed.

Mountain pine beetle, *Dendroctonus ponderosae* Hopk. No new outbreaks of this insect were detected on State or private lands this year. However, mortality of single ponderosa pines and small groups of several trees continued in northern New Mexico. This bark beetle prefers to attack overmature trees.

Western pine beetle, *Dendroctonus brevicomis* LeC. Although scattered ponderosa pines were lost to this bark beetle, the number detected in an aerial survey of State and private lands was greatly reduced from that reported in 1977. One small infestation on private

land near Chama was controlled by appropriate tree removal and utilization of the wood for firewood. In this area, all but two of the trees attacked had been struck by lightning.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. The only major tree losses caused by bark beetles were caused by this beetle. As with other beetle species, the number of trees killed was down considerably. In remote areas of the Vermejo Park property, groups of 25 to 100 Douglas-fir trees were killed in drainage bottoms and on poor sites. Inaccessibility prevented salvage attempts. Further decreases in populations were expected in 1979.

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